

PROBLEMATICS OF DIFFERENT TECHNICAL MAINTENANCE FOR COMPUTERS

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Translation of "K problematike technickej obsluhy pocitacov,"  
Mechanizace a Automatizace Administrativy,  
Vol. 15, No. 12, 1975, pp. 511-512



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| 1. Report No.<br>NASA TM 75123                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2. Government Accession No.                          | 3. Recipient's Catalog No.                               |           |
| 4. Title and Subtitle<br>PROBLEMATICS OF DIFFERENT TECHNICAL<br>MAINTENANCE FOR COMPUTERS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      | 5. Report Date<br>August 1977                            |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                      | 6. Performing Organization Code                          |           |
| 7. Author(s)<br>Z. Dostalek, VS UTAR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      | 8. Performing Organization Report No.                    |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                      | 10. Work Unit No.                                        |           |
| 9. Performing Organization Name and Address<br>Leo Kanner Associates<br>Redwood City, California 94063                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      | 11. Contract or Grant No.<br>RA 35372-B                  |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                      | 13. Type of Report and Period Covered<br>Translation     |           |
| 12. Sponsoring Agency Name and Address<br>National Aeronautics and Space Admin-<br>istration, Washington, D.C. 20546                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      | 14. Sponsoring Agency Code                               |           |
| 15. Supplementary Notes<br><br>Translation of "K problematike technickej obsluhy<br>pocitacov," Mechanizace a Automatizace Administrativy,<br>Vol. 15, No. 12, 1975, pp. 511-512                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                      |                                                          |           |
| 16. Abstract<br><br>The first basic service that will in the future be provided to the NOTO organization is technical servicing of computer systems. Heretofore the case was otherwise, since computer customers were provided with technical maintenance mainly by their own workers. For example, with our most wide-spread medium-sized computer, the Tesla 200, the supplier guarantees servicing in 46% of operational computers. In the remainder of the systems, the percentage is significantly lower. The reason for this involves several facts, which affect the inclusion of technical servicing under our conditions. We shall print in addition results from an 8-year experiment by the Computing Center of the Institute of Technology and Dialectics of the ZTS in Martine. |                                                      |                                                          |           |
| 17. Key Words (Selected by Author(s))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                      | 18. Distribution Statement<br><br>Unclassified-Unlimited |           |
| 19. Security Classif. (of this report)<br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 20. Security Classif. (of this page)<br>Unclassified | 21. No. of Pages                                         | 22. Price |

## PROBLEMATICS OF DIFFERENT TECHNICAL MAINTENANCE FOR COMPUTERS

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A computing center equipped with an intermediate-capacity computer represents in investment cost an amount equal to that of the production of the entire business enterprise. It is therefore understandable that the earning capacity of a computer center be critically appraised by leading economists. /51

It is unacceptable when errors occur in the computer which developed as a result of the breakdown of technical equipment. Confidence in the computer goes down very rapidly and forces a skeptical opinion of its serviceability in a given organization. A computer, compared with other production modes, has a disadvantage here, in that within the framework of its overall life expectancy, it must maintain 100% accuracy, which distinguishes it, for example, from operating machines, where with advancing age of the machine, a deterioration in accuracy and its use in inferior work are permitted.

The suppliers of computer systems are taking a number of precautions, by means of which a defect-free standard is maintained for the system. One of these precautions involves preventive measures which have ascertained potentially dangerous defects "in advance" of occurrence and diagnostic measures, which have originated in identifying a defect in the shortest possible time, in order to rapidly intervene and eliminate it.

In both cases, with regard to efficiency, the state of perfection of the medium and the experience of the workers in technical maintenance are definite. Prediction of defects in

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\*Numbers in the margin indicate pagination in the foreign text.

the system has two parts, as follows:

- testing the computer in preventive modes, such as under conditions "more severe" than in ordinary operation,
- special preventive maintenance of the equipment.

The success and effectiveness of the first part depends on the perfection of the test procedures, which the computer manufacturer develops. The second part, i.e. maintenance, depends on the specialized experience of the technicians, their calculations, a suitable measuring technique, a sufficient amount of spare parts, and last but not least the details of technical documentation and the conditions of maintaining the equipment. It is necessary to emphasize that with the relatively rapid modifications of computers by individual manufacturers, one is sometimes unsuccessful in bringing the field under perfect control.

As to the source of a defect in technical equipment, insofar as there may be many apparent defects, diagnostic measures are involved. The effect of these, as in the preceding case, likewise depends on the resources which the manufacturers have provided and on their representatives who make up the group of technical maintenance workers. Among the resources which constitute a component part of delivery belong such items as a suitable operational and supervisory system, which reports defects in technical performance, clear documentation of defects and the search for them, perfection in measuring techniques for electronic and mechanical parts, and suitable performance in the repair equipment, material, and spare parts. It is then dependent upon the technical-service workers to be specialized to a certain degree and trained on a given type of computer. Break-downs in mechanical parts are quite unacceptable; therefore mechanics are most necessary in a technical-maintenance collective.

Two modes of operations are used predominantly in technical maintenance:

- technical servicing provided by the supplier of the technical equipment, such as a computer being equipped with a so-called peripheral unit (to provide the main equipment with an auxiliary) and further technical actions on the part of the computing center (climatization, fire prevention, etc.),
- special technical maintenance by the user of the computer technology.

Both modes have their advantages and disadvantages, and opinions on the grounds for using one or the other differ significantly.

Technical servicing provided by the manufacturer of the computer technology has a much better departmental and economic environment, since technical maintenance is guaranteed by the proprietor of the technology.

The manufacturer has the opportunity of obtaining the most qualified workers from the industry, who are acquainted with the given type of computer. There is the possibility of thorough training and supplementary schooling of his workers directly in the industry, possibly at research centers. It is similarly the case with materials guarantees, such as with spare parts apparatus, special equipment, etc.

Economical results are produced by a servicing group which takes care of the greatest number of computing centers, whereby the productivity of the maintenance worker increases, so that the required number of workers declines to 1-2 workers for every computer.

The advantages of doing one's own maintenance of the center result especially from the "in-house surroundings." The workers are more interested in the error-free operation of the computing center, are well-acquainted with "their own" computer and its weaknesses, and also when defects occur, they can frequently go "with certainty" to the defective site. They have worked out their own testing of enhancements, and the electronics technicians have noted the scope and made charts of values directly on the housing on panels and grids, etc. Searching for defects is done with teams, with the leader of the team specifying a number of points, and assistant placing the probes, and another worker reading values from an oscilloscope.

Probably the greatest advantage, however, is provided by immediate availability for repair, since the computer's malfunction is generally disturbingly expressed in the results of the computing center, and a significant breakdown may be brought under control in a limited amount of time.

If conditions then are such that maintenance must be carried out, is it to be provided by the manufacturer or not?

Appearance of repair workers should be in a short a time as possible. The permissible period ought to exceed half a shift, i.e. about 4 hours. In the remaining 4 hours, a complicated breakdown could be pinpointed and eliminated, so that the computer malfunction does not go beyond one shift. It could be rectified in the course of 24 hours, such as by working on the third shift. In order to fulfill such conditions, maintenance must be done using a sufficient number of maintenance repair workers, as with automobiles, equipped with an assortment of spare parts, measuring techniques, and repair devices. Repair may be done in the exceptional case by an individual; of course one must give precedence to a coordinated team of specialists.

In closing, one must in addition evaluate the economic question.

The maintenance of computers, whether one is already provided with servicing or one has one's own workers, is a relatively expensive affair. The monthly fee for technical servicing amounts to several tens of thousands of crowns. Training of one's own workers ordinarily costs hundreds of thousands. In both cases, moreover, one must add the cost of buying spare parts or measuring apparatus, which, over a year, likewise attains a value of hundreds of thousands.

On the other hand, purposive technical maintenance reduces errors to an acceptable level, whereby confidence in the computer increases, which is considerable. To clarify as the values which it is possible to attain in technical maintenance, we shall give the results from our own computing center, which our own technical-servicing department has. The department carries out the maintenance of two computers, one a Minsk 22, which was installed in 1966, and the other a Tesla 200, installed in 1970. In addition to this, the unit performs certain tasks for the RV and T plan, such as bringing up another Tesla 200 system and an EC 1030 system, joining a coordinate printer to a Tesla 270 system, running a Memorex memory disk for the Tesla 200 system, introducing magnetic-tape records, and a number of other tasks, for an overall annual projected cost of 300,000 Czech crowns. The department has 10 workers altogether. At the time of computer operation, exceptionally favorable results were recorded for low loss of machine time using technical operations. In the table following, the values in percent are compared with overall down-time, by year. /512

TABLE

Minsk 22

maintenance  
down-time

| 1967    | 1968   | 1969   | 1970   | 1971   | 1972   | 1973   |
|---------|--------|--------|--------|--------|--------|--------|
| 17,9 %  | 9,7 %  | 6,08 % | 6,52 % | 5,02 % | 5,65 % | 5,90 % |
| 10,85 % | 2,43 % | 3,81 % | 1,02 % | 0,78 % | 0,66 % | 1,73 % |

Tesla 200

maintenance  
down-time

| 1971   | 1972  | 1973  |
|--------|-------|-------|
| 11,8 % | 8,7 % | 5,6 % |
| 19,4 % | 7 %   | 5,6 % |

